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10/816,503	04/01/2004	Hong-Jyh Li	2004P51130US/I331.128.101	8623

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Dicke, Billig & Czaja, PLLC  
Suite 2250  
Fifth Street Towers  
100 South Fifth Street  
Minneapolis, MN 55402

EXAMINER

JOHNSTON, PHILLIP A

ART UNIT	PAPER NUMBER
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2881

DATE MAILED: 03/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/816,503

Applicant(s)

LI, HONG-JYH

Examiner

Phillip A. Johnston

Art Unit

2881

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 23 December 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-31 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_.

***Detailed Action***

1. This Office Action is submitted in response to Amendment filed 12-23-2005, wherein claims 1,8,12,16,19, and 25 have been amended. Claims 1-31 are pending.

***Examiners Response to Arguments***

2. Applicants arguments are moot in view of new grounds for rejection.

***Claims Rejection – 35 U.S.C. 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

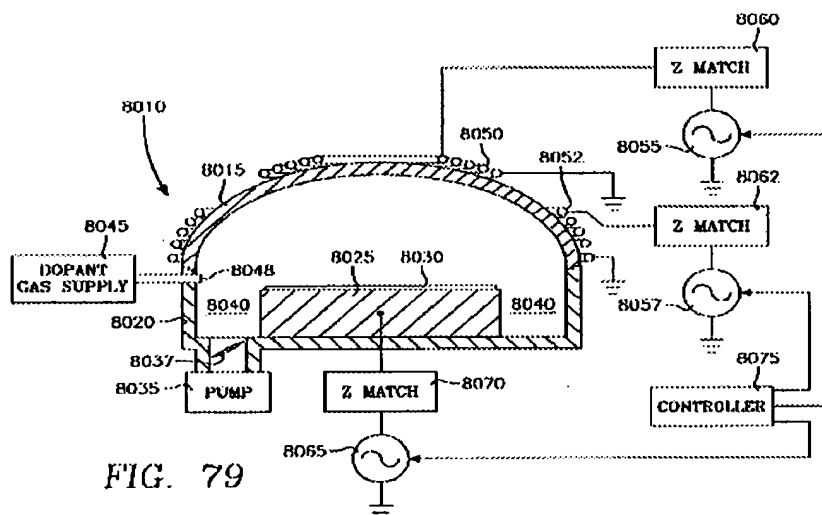
(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Pub. No. 2004/0107909 to Collins, and Lee, U.S. Patent No. 6,670,224, in view of Watanabe, U.S. Patent Pub. No. 2005/0247985.

Collins (909) discloses the following;

(a) A plasma immersion ion implantation apparatus that includes vacuum chamber 8010, pump 8035, wafer holder 8025, gas supply 8045, and plasma

See paragraphs [0249] - [0251]; and Figure 79 below;



See paragraph [0249];

See paragraph [0277];

(d) Plasma source current alternating at RF frequency equivalent to the AC voltage source recited in claims 5,24, and 29. See paragraph [0126];

(e) An apparatus and method of fabricating a MOSFET having high-k SiO<sub>2</sub> dielectric layer 9962, doped with Nitrogen (N) ions via implantation, as recited in claims 1,8,12,16-19, and 25. See paragraphs [0310]; [0321]; Figures 109 and 110 below:

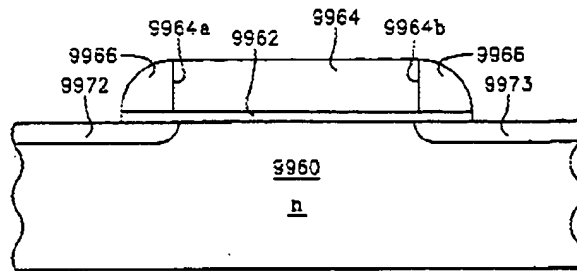


FIG. 109

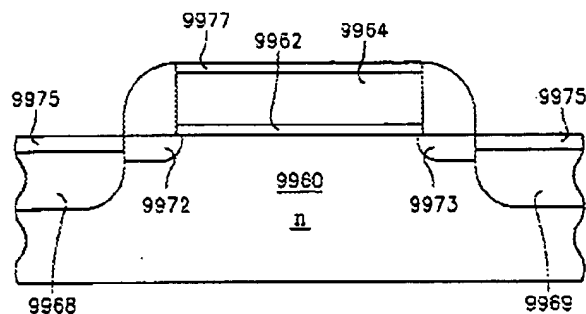


FIG. 110

Collins (909) as applied above fails to teach the use of a buffer layer, as recited in claims 13-15, 20-22, 30 and 31. However, Lee (224) discloses a method of manufacturing thin film transistors having a SiN buffer layer 302 adjacent SiO dielectric layer 306. The buffer layer is subsequently doped with Ge via ion implantation at a dose rate of  $10^{16}$  ions/ $\text{mc}^2$  at an ion energy of 10-100 kev, as recited in claims 13-15, 20-22, 30 and 31. see Column 3, line 28-65; Column 5, line 11-20; and Figures 1, 2, and 11 below;

Therefore it would have been obvious to one of ordinary skill in the art that the ion implantation apparatus and method of Collins (909) can be modified to use the

buffer layer forming method of Lee (224), to provide a Silicon Nitride layer that is formed on a substrate as a buffer layer.

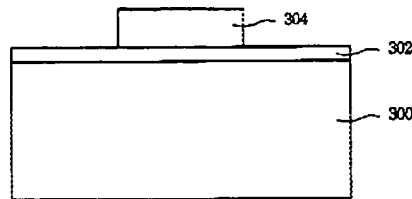


Fig. 1

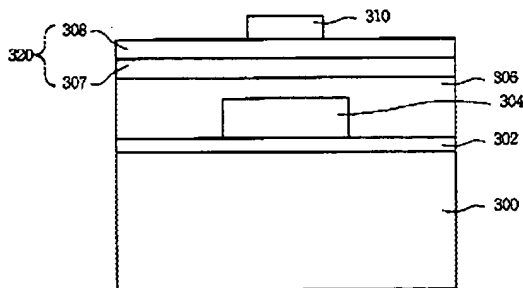


Fig. 2

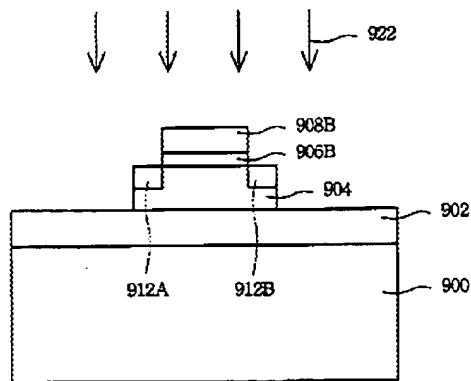
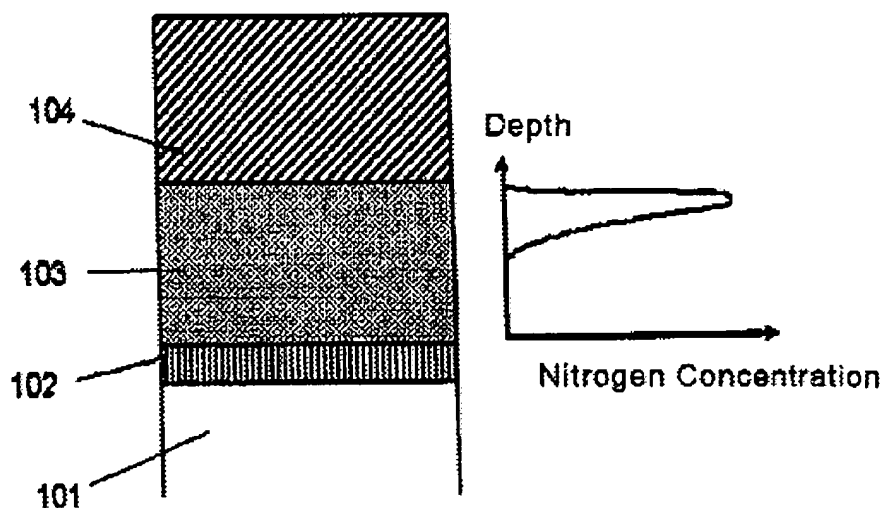


Fig. 11

The combination of Collins (909) and Lee (224) fails to teach the use of a high-k dielectric layer having a k-value greater than 9, as recited in amended claims 1,8,16,

and 25. However, Watanabe (985) discloses a MOSFET with dielectric insulating layer 103 made of high-k materials including  $\text{Al}_2\text{O}_3$  and  $\text{HfSiO}$  that are subjected to plasma nitridation, as recited in claims 1,8,16, and 25. See paragraphs [0071] and [0083]; and Figure 1 below.

Fig. 1



Therefore it would have been obvious to one of ordinary skill in the art that the ion implantation apparatus and method of Collins (909) and Lee (224) can be modified to use the high-k dielectric layer materials of Watanabe (985), to provide a manufacturing method for a semiconductor Device, where the high-dielectric-constant insulating film, which is made of metal oxide or metal silicate, is irradiated with a nitrogen containing plasma, thereby improving the thermal stability of the high-dielectric-constant insulating film, suppressing the dopant penetration and, preventing electric characteristics of the interface with the silicon substrate from deteriorating.

***Conclusion***

5. The Amendment filed on 12-23-2005 has been considered but the arguments are moot in view of new grounds for rejection.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

6. Any inquiry concerning this communication or earlier communications should be directed to Phillip Johnston whose telephone number is (571) 272-2475. The examiner can normally be reached on Monday-Friday from 6:30 am to 3:00 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiners supervisor John Lee




can be reached at (571) 272-2477. The fax phone number for the organization where the application or proceeding is assigned is 571 273 8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PJ

March 8, 2006

  
JOHN R. LEE  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800